

## Book Reviews and Bibliographical Notes.

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**The Functions of the Brain.** By DAVID FERRIER, M.D., LL.D., F.R.S. SECOND EDITION. G. P. Putnam's Sons, 1886.

As a rule, second editions of a popular scientific work do not call for extended notice, nor for another critical review. Not so with Ferrier's "Functions of the Brain." This second edition is practically a new treatise, and bears splendid testimony to the immense additions that have been made to our knowledge of the anatomy and physiology of the nervous system (and of the brain in particular) during the decade that elapsed between the appearance of the first and second editions of this work.

That Ferrier has been an earnest student of the literature of the special subject which he is investigating no one can deny—at least no one who casts more than a cursory glance over these pages. He has assimilated a great deal of knowledge for which he is indebted to the investigations of others, and yet on the great question of the localization of cerebral functions—by which this work must be judged as the first edition was—he stands as he formerly did. "The principal doctrines formerly advocated . . . are maintained in all essentials unchanged." What does this signify? Does this mean that Ferrier's experiments and conclusions are so far beyond reproach that the position he assumes is an impregnable one; or must we regard him as an enthusiast who can neither appreciate the good in the methods of others nor the blemishes in his own? Let us see!

Before the first edition of Ferrier's book appeared (in 1876), the question of the localization of functions has been studied by Flourens, Brown-Séquard, Schiff, Fritsch and Hitzig, and Nothnagel, while Goltz had published his first article only a short time previously; since that time the question has been studied and discussed by Munk, Goltz, Exner, Loeb, Luciani and Sepilli, Ferrier, and possibly a host of others. Experimental physiology and human pathology have given strong evidence in favor of a specialization of cortical centres: Goltz alone, of late years (supported, to be sure, on various occasions by no lesser lights than v. Gudden and Nothnagel), has stood out in open opposition to the doctrine of a strict localization, and has brought upon himself the criticisms and often the vituperations of the "localizers." To the credit of Ferrier be it said that he treats Goltz's conclusions with the con-

sideration which a true genius<sup>1</sup> deserves. But there has been little harmony among the "localizers" themselves. Fritsch and Hitzig could not agree to the exact localization of Ferrier's centres. Munk also ridiculed Ferrier's centres, and, by way of return, Ferrier snubs Munk. Loeb, under the inspiration of Goltz, demolishes Munk's visual centres, while Luciani and Sepilli agree in some points with Munk, in others with Goltz or Exner, and in a few with Ferrier. Where lies the truth? In all likelihood, midway between the extremes.

In spite of all the hostile criticism that has been passed upon it, Ferrier still upholds his old method of experimentation—the method of determining the locality of the various centres in the cortex by *electrical stimulation*. The one serious objection to this method is, that there is no telling where the current will diffuse to, and that movements resulting from electrical irritation of the cortex may be due to the influence of the currents, not upon the cortical cells, but upon the subjacent white fibres. But Ferrier argues (p. 230), "if the medullary fibres are differentiated in function, the regions to which they are distributed must be similarly differentiated." True; but, with areas as small as those of the author, I can hardly conceive that fibres going to *neighboring* areas should not receive part of the current as well. (Some of the author's recent and most brilliant experiments have been based upon the method of removal with the knife, and in this the application of antiseptic principles has stood him in good stead.) All the old facts and most of the old cuts fixing the little fanciful circles upon the brains of jackals, monkeys, dogs, cats, and rabbits appear again; but as the method is not convincing, the conclusions cannot be credited. It will be seen that, with very few exceptions, the circles representing movements of distinct muscular groups remain within the areas now agreed upon by pathologists at least, as representing the leg, arm, and face centres respectively. In other words, Ferrier attempts a minute differentiation which no one else is willing to adopt. And certain it is that any one who, like the present writer, has seen Goltz remove a half-dozen or more of Ferrier's centres at a single operation,<sup>2</sup> and who afterward observed the same animal running about as well as ever, will not believe in these carefully circumscribed areas, whatever other view pathological findings may induce him to hold. We have dwelt at some length upon this question of circumscribed motor areas to insist

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<sup>1</sup> The fact is often overlooked that Goltz has proved himself the keenest of all observers; but for his ingenious suggestions (to mention a single fact only), the methods of testing the disturbed sensory and motor faculties of animals would be far less refined than they are at present.

<sup>2</sup> The unfortunate experiences of Goltz in exhibiting (at London and Berlin) the brains of the animals operated upon renders it doubtful whether he has in every case removed an entire occipital cortex, or an entire arm centre, and the like; but that many of Ferrier's centres have been removed without the expected result cannot be doubted.

upon the points of difference between Ferrier's views and those of other investigators.

In determining the location of the sensory centres, the author very naturally makes liberal use of the facts of human pathology. His view of the value of pathological findings is the orthodox view of a physiologist: "Clinical cases are mainly valuable as confirmatory of physiological experiments, and more especially as supplying negative instances. A case, however otherwise complicated, of total destruction of a region in which a certain function is supposed to be localized, without loss or impairment of the function assigned to it, outweighs a thousand positive instances in which a causal relationship seems to be established between the particular region and the function in question." With this most of us will be disposed to agree in the main; but, after all, too much importance must not be attached to *single* cases. Kussmaul has recently reported two cases of total loss of first temporal convolution without sensory aphasia, and yet, unless negative instances are multiplied, there is good reason for associating sensory aphasia with a lesion of the convolution in question. In the location of the various sensory centres Ferrier is again at variance with almost all other authors.

In the first edition, Ferrier relegated the visual centre to the angular gyrus, electrical excitation of which produced movement of the eyeballs, contraction of the pupils, etc., which the author interpreted to be reflex movements consequent on the excitation of subjective visual sensation (p. 164 of first edition). At present, no one would argue that visual impressions must be received (apperceived) in the same area from which movements of the eyes are excited. Association fibres would come into play here.

In the second edition, p. 271, the author says: "The visual centres embrace not only the angular gyri, but also the occipital lobes, which together I term the occipito-angular regions." In the chapter that follows (*mirabile dictu*) the author takes all possible pain to show that the occipital lobes have little, if anything, to do with vision, and what the exact function of the occipital lobes is, according to Dr. Ferrier, we challenge any one to find out. If, angular gyrus = 1, and occipital lobes = 0,  $1 + 0 = 1$ . Why not retain the angular gyrus as sole visual centre?

The relation of the angular gyrus to vision is explained by other authors on the ground that the optic radiations into the occipital lobe pass beneath the angular gyrus, and that lesion of the angular gyrus could interfere with these optic fibres. In one case, which was examined with regard to this point, Ferrier states (p. 282): angular gyri had been completely obliterated, but the occipital lobes and the optic radiations . . . passing backwards into them were uninjured. Was this determined by microscopical examination or by mere superficial inspection? No further statements are made, and the proof of Ferrier's position is, therefore, extremely unsatisfactory.

With the exception of Ferrier, clinicians and physiologists believe that the occipital lobes have much more to do with vision and with the special disturbance known as hemianopsia than the angular gyrus has. Ferrier claims (p. 295) clinical facts . . . do not establish any relation between hemiopia and lesion of the occipital lobe as such, apart from the angular gyrus. It is very strange, indeed, that Dr. Ferrier does not take note of the conclusions of two American authors who have proved that such a relation does exist. The cases analyzed by Dr. Starr and Dr. Seguin have established this relation, and both these articles must surely have been in the author's hands before writing his preface.

Dr. Seguin's facts showing the relations of the cuneus to hemianopsia has met with general favor, and since the publication of his article, further cases in corroboration of his views have been reported by Seguin, Gruening, and Hun. When Meynert stated ("Psychiatry," p. 144) that Ferrier's centres have met with opposition from *all* other authors, British critics regretted Meynert's "national bias." We beg to state that in making the above strictures, we are not actuated by any such bias, but that we have not come across a more remarkable exhibition of "*hedging*" than is offered in this chapter on the visual centre.

Of the other centres, we have only to say that Ferrier locates the function of hearing in the superior temporo-sphenoidal convolution (in general agreement with other authors), tactile and general sensibility is referred to the hippocampal region; that the hippocampal lobule has relations to the sense of smell, while the author does not venture to indicate where taste has its central seat. How about tactile centres near the motor areas?

We do not feel that the question of cortical localization has been cleared up by the publication of this second edition. Coming as it does after the excellent monograph of Luciani and Sepilli, it marks a retrogression rather than an advance toward more perfect knowledge. Of this discussion on cortical centres, Ferrier may well say *magna pars fui*, to which we add, *non maxima*. Aside from other considerations, we do not think this book a safe one to put into the hands of students of physiology or psychology, unless it be to make them acquainted with one extreme view. The contest is still waging over this question of localization, but when such rational localizers as Luciani and Sepilli state that disturbances of vision can be caused by lesion in so many different parts of the brain that, properly speaking, the visual centres cannot be accurately limited, we leave Ferrier, Hitzig, and Munk, and incline distinctly toward the views of Goltz. We have no intention of entering any special plea at present, but we have a strong conviction that the conservative opinions on localization will in the end carry the day. However specialized the functions of different parts of the cortex may be, he who analyzes the simplest act—plucking a flower—will note how widely separated portions of the cortex will be engaged in the performance of this single act. But to return to the work: a great deal of excellent information has been col-

lected and sifted regarding the anatomy and physiology of the spinal cord, cerebellum, and cerebral ganglia. All these chapters are excellently written, and the subject matter is discussed in an entirely impersonal way. We commend them as readable summaries of our present knowledge. The typographical work is beyond praise.

B. S.